Original Article

Motor and dietary education against obesity for students: Evidence from Italy

LUISA VARRIALE, PAOLA BRIGANTI, GLORIA GUILLOT, ANTONIO ASCIONE

Department of Motor Science and Wellbeing, University Parthenope of Naples, Naples, Italy

ABSTRACT

This study aims to analyse and measure the effects of a specific pilot program on "Motor and Dietary Literacy" (MDL) implemented in Italian schools. An interview based survey was conducted on a sample of 85 students. The results support the hypothesis that proper education and training of students may have a positive impact on preventing physical inactivity and poor diet phenomena. MDL educating sparked a remarkable attitude of awareness and alert among students with respect to obesity. These results show that motor and dietary education can be a cornerstone to promote healthy life-styles. **Keywords:** Motor and dietary literacy; MDL; Educational development; School; Students; Obesity.

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Corresponding author. *Department of Motor Science and Wellbeing, University Parthenope of Naples, Naples, Italy.*
E-mail: antonio.ascione@uniparthenope.it
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INTRODUCTION

The World Health Organization (WHO) defines physical activity as "any effort exerted by the skeletal muscle system which results in a power consumption greater than that in the rest position". According to WHO reports, the number of obese or overweight children of age five or less increased from 31 million in 1990 to 41 million in 2014, with an increase in incidence from 4, 8% to 6.1%. Such a worrisome trend affects primarily children living in low-middle income Countries and highlights the urgent need to devise and deploy dedicated actions. The WHO has termed this problem as the "silent global epidemic" to emphasize the its subtlety.

A sedentary lifestyle, according to the WHO, is to be considered among the main risk factors for health, together with disordered eating, overweight, obesity, excessive alcohol consumption, and smoking. There insubstantial scientific evidence of the damage caused by "sedentary lifestyle", as well as the beneficial impact of regular "exercise", often regarded as having even broader effect on health than the pharmacological and surgical treatments. It appears today therefore a top priority to fight both poor nutrition and physical inactivity, which are often paired.

In this study, we report the results of a motor and dietary literacy (MDL) action that was designed, implemented, and evaluated to prove the behavioural effects and motivate a more conscious lifestyle by raising the awareness towards healthy eating and active lifestyle. Such an action stems from an original pilot project set up by the Ministry of Education, Universities and Research (MIUR) and the Italian National Olympic Committee (CONI), with the addition of a dietary education module and a statistical survey to measure the effects on students. After recalling the legal and social context, we describe the MDL action and present a case study, showing statistical data gathered before and after MDL administration in a school in the South of Italy (Campania Region).

BACKGROUND

Childhood obesity and the "obesogenic" environment: facts and figures

Childhood obesity is a major social problem associated with two factors: sedentary lifestyle and poor diet. The phenomenon, that in Italy affects one in four children, is the result of a protracted energy unbalance caused by excessive calories uptake compared to their consumption. Yet, the definitions of both overweight and obesity is more complex for children than for adults, whose ideal weight is conventionally estimated based on the Body Mass Index (BMI), computed as the ratio of the weight in kilograms divided by squared height in meters (Confalone, 2002). To define overweight and obese children, according to the WHO we can use the "score" of a modified BMI (Cole, 2000) developed using several datasets collected worldwide, which provides a useful international reference to compare across populations from different Countries.

In Italy, the Italian Ministry of Health defines an obese child as one with a weight exceeding 20% of the norm, and an overweight child as one whose weight exceeds the norm by 10-20%. Alternatively, an overweight condition is signalled by a BMI greater than expected (like in adults). The weight growth of the baby is calculated using the percentiles tables, which bring together the percentage of children by weight and height values, broken down by sex and age (Confalone, 2002).According to recent studies carried out in 2000 by the NCHS (National Center for Health Statistics US), the normal growth corresponds to the median of a standard weight distribution function. An overweight condition is identified by a weight falling in the 85-95% percentile range, whereas an obese child falls at and above the 95th percentile (Kuczmarski, 2000).In Italy, figures by UNICEF in collaboration with Istat (Italian Institute of Statistics), indicate a large incidence with 3 out of 10 adults (32%) overweight and 1out of 10 is obese (11%), for a total about 42% of adults with "body

fat" issues. The future outlook looks grim when considering that Italy has one of the highest rates of childhood obesity among Western countries, second only to the United States, and the percentages have increased tenfold from the seventies of the last century. Nowadays, the 26.9% of the Italian children of age 6 to 17 years is overweight, with considerable peaks in the South and in the islands, especially for children of age 6-10 years (peaking at 35.7%, i.e. about one million children in total – source Ministry of Health, 2012). Geographical differences exist because in some regions with lesser physical activity, such as Campania (targeted in this study), overweight children amount to the 49% of the children population. Significant differences exist also by age, since the figures for overweight children drops from 25.2% in the age of 3-11 year old down to 17.3% for 11-14 years old. Yet, in two out of three cases, an overweight child will become an obese adult, with consequences for the health system.

The WHO cautions that the "obesogenic" environment characterizing the Western Countries poses a major threat in terms of reduction in life expectancy and more diseases in elderly, thus placing a huge burden on our society. As a counter-action, we need to tackle root educational causes. Together with an incorrect and unbalanced eating style, reduced physical activity (i.e. physical inactivity) represents another major risk factor towards obesity, which is often the result of a lazy lifestyle more and more usual among young people. To this end, an incomplete sample of common habits include (i) relying on car (accompanied by their parents), (ii) taking the elevator when moving up (down) one floor with no loads, and (iii) spending many hours in front of computers and television to the expense of outdoor time. Instead, exercising in proper amount and quality is crucial for the growing child, as it makes him/her lose weight and be more active while helping rebalancing the proportions of lean mass (muscle) and body fat (adipose tissue) (Confalone, 2002). Noteworthy, it shall be well underlined the difference between sport and physical activity, the latter being in the reach of all individuals and the sole target in the scope of the literacy action reported here.

Regulatory framework

In Italy, a preventive action of Motor Literacy (translated from Italian "Alfabetizzazione Motoria") was set in place first starting in 2010-2011, as a joint effort between the Ministry of University, Research and Education (MIUR) and the "Ministry of Regional Affairs, Tourism and Sports" through CONI (the Italian National Olympic Committee) targeting the primary school (i.e. 6-11 years old schoolers). The declared objective of this initiative was to educate the population toward the improvement in the motor skills and lifestyles by starting from the primary school and promoting a correct and (geographically) uniform motor education program.

Such a motor literacy action took off as a pilot project in 31 provinces in 2010, being readily extended by MIUR and CONI to 103 provinces in 2011 and to the entire nation in 2013. By a methodological standpoint, the action begins by measuring the motor capabilities of students, including those with disabilities, at the beginning through checklists related to predetermined exercise pathways, resulting in a global performance parameter that is measured again at the end of the education program. In addition, surveys are administered to grade the level of appreciation of teachers and families, as well as to get a self-evaluation by grown-up children (grades IV e V, roughly 9 and 10 years old respectively). The teacher in chief of each classroom is supported by an expert to drive students through the subsequent milestones in the development of motor skills guidelines set by the Ministries overseeing the initiatives.

Definition of Motor Literacy

Literacy is the quality or state of being literate (Merriam-Webster's definition) and the degree of development of individual reading and writing skills. In a broader sense, it can be also understood as a body of activities providing "illiterate" people with the cultural tools sufficient to enable them to read and write. It can refer also to the activity of providing use of instruments of particular languages, as in this case.

The "motor literacy" refers to the development of individual capabilities of self-movement and of moving around within a team or group dynamic. This was the focus of the CONI-MIUR "motor literacy" project for primary schools in an attempt to bridge an educational gap and to counter obesity trends. We investigate the actual impact of motor literacy, augmented synergistically with nutrition education, on promoting to educational upgrade toward healthier lifestyle.

METHODOLOGY

The deployed action on MDL literacy

The original program on Motor Literacy proposed by MIUR is detailed online in an annex posted on the CONI website (www.alfabetizzazionemotoria.it) and consists of in-class courses for the different age groups. In parallel to such a motor literacy courses, we propose to add also a "Dietary Literacy" course, obtaining a compounded MDL action. As part of the proposed approach, the MDL action is supported by a simple semi-structured questionnaire (discussed later) on food and lifestyle, helping measuring the effectivity of our action.

The rationale for adding the nutritional education lays in the need to bring students to consume food with awareness, by highlighting the importance of an healthy and balanced eating style, also by acknowledging that young students in the targeted age group (5-11 years old) often show a low consumption of vegetables and a high consumption of snacks.

Through interactive classroom lessons, in which the students were made part of the correct rules and good eating habits, they were guided by teachers in an "active" observation and discovery of the food. They were exposed to food handling and exploration activities, selected to match their expressed interests and needs. Posters, photos and other documents of the work performed were produced by students themselves and finally displayed to parents during the final stages of the MDL action.

With reference to the case study staged in South of Italy and examined later in this paper, the MDL project began in April 2014 at a rate of two hours per week until the end of the school year, for a maximum of 30 hours per year per class. During these 30 hours, the chief physical education teacher was supported by an external expert tutor, who helped the teacher devising a work plan for promoting outdoor and in-classroom activities related to sport. The training was structured in two groups, different by content and objectives: children of 5-7 years old (grades 1, 2 out of 5) and 8-11 years old (grades 3, 4, 5 out of 5). The former aim sat developing basic motor skills, while the latter ones aim at developing true pre-sports skills, requiring greater recourse to coded games with several rules. At the end of the 30 hours, a final event with the participation of the parents was organized to demonstrate the progress made by the children and reinforce the key message, projecting it from school to families.

In the following, since the motor literacy is well known and documented in many sources, the emphasis in the discussion will be on the educational dietary aspects.

Questionnaire, sample, analysis

The adopted statistical methodology consists of the analysis of the above-mentioned additional questionnaire (ref. Annex) administered before and after the action. Our questionnaire is simple enough to be filled by young students, who thus can provide info about their own eating habits during meals, first on the beginning of the MDL training and then at the end. The questionnaire contains 19 items, of which 4 are an graphical, 6 about motor activities, and 10 on nutritional education. The questionnaire is semi-structured in the sense that some questions are open and no Likert scale exists.

The collected data, duly processed, allows for a statistical analysis by "categorical variables" coded in terms of number of occurrences. We opted for using "occurrences" (counts) data in place of "frequencies" of occurrence to better highlight the size differences between sub-groups in the sample (e.g. with respect to age, sex and origin). The choice of this approach is justified by the fact that a regression study is not possible because we are not dealing with quantitative variables, whereas the cross-correlations are best highlighted graphically by classifying the data "two-ways" by categories-pair(e.g. response before and after the MDL course). The statistical analysis was performed using the software package MINITAB©.

The questionnaire was administered on April and June 2014 on a group of 85 young students (our statistical sample), encompassing 49 males and 36 females between 5-12 years of age and attending all grades (from 1 to 5) of the selected primary school in Campania. By a geographical distribution, they lived in different neighbouring areas: 63 from "Pianura" suburb, 16 from Naples city, and 6 from other places in the province of Naples. By the age group, the majority of students was 7-10 years old, namely:19 individuals were 5- 7 years old, 61 were 8-10 years old, and three were 11-12 years old. The results are discussed in aggregate form first, and then by comparing between males vs. females to highlight different impacts of literacy with respect to gender.

The 85 questionnaires were administered before and after surgery motor literacy within 6 months of the 2014-2015 school year. The students took the questionnaire before and after their involvement in MDL, together with a group of parents who had volunteered and later rated positively the "professional" support activity on MDL in primary school in terms of efficacy and practicality.

RESULTS AND DISCUSSION

The case study was carried out at the primary school "Russolillo" located at Pianura, a comprehensive school site in the north of Naples (Italy) characterized by a broad basin of students mainly made up of young and single income families, with some socio-cultural disadvantages, such as: (i) the presence on the territory of many drug dealing groups, (ii) the high unemployment and (iii) frequent acts of micro-crimes. The school has operated for many years in this difficult social environment by seeking to prompt various cultural and sport events with the help of the European Structural Funds (POR-FESR), especially trying to promote sports activities as a means to in still "a sense of compliance with the rules through sport".

Motor education against sedentarily

The results obtained with the MDL were evident in terms of greater attention to motor practice. The first basic message of MDL was the difference between sport and physical activity. Although very often (erroneously) assimilated or identified, these two categories of exercise are distinct, with sport referring to a structured setting (e.g. gym or playing field) and the second most pervasive in the general lifestyle of each individual (e.g. transportation mode, amount if walking, etc.). Figure 1 shows precisely the results about the awareness of the statistical sample towards such a difference between sport and physical activity, before Vs. after MDL. Interestingly, while no change was detected regarding the attitude about "sports", the MDL brought a significant change in the sample about the practice of motor activities. On the one hand this result demonstrates undoubtedly the greater awareness and competence gained from the educational action, but on the other hand it signifies a real modification in the daily routine. To confirm this statement, Figure 2 shows the change in the daily travel behaviour, with a marked increase in the percentage of students that decided to move by "walk", causing a reduction in car use. The graph also shows that the sub-sample that initially had claimed no practice by ticking "NO ANSWER" (left-most panel),after the MDL largely retreated their answer by declaring MDL practice, across the (right-most panel).

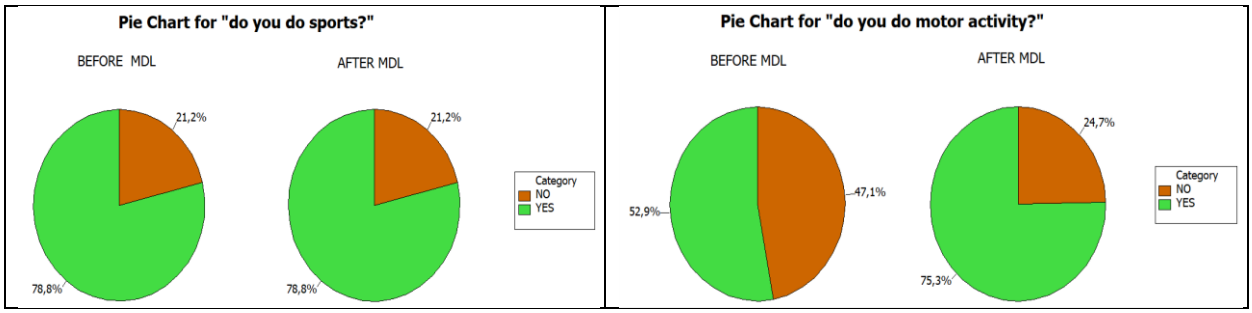

Figure 1a. Sport (left) and motor activity (right). The data indicate that the MDL effects are greater awareness and practice of physical activity

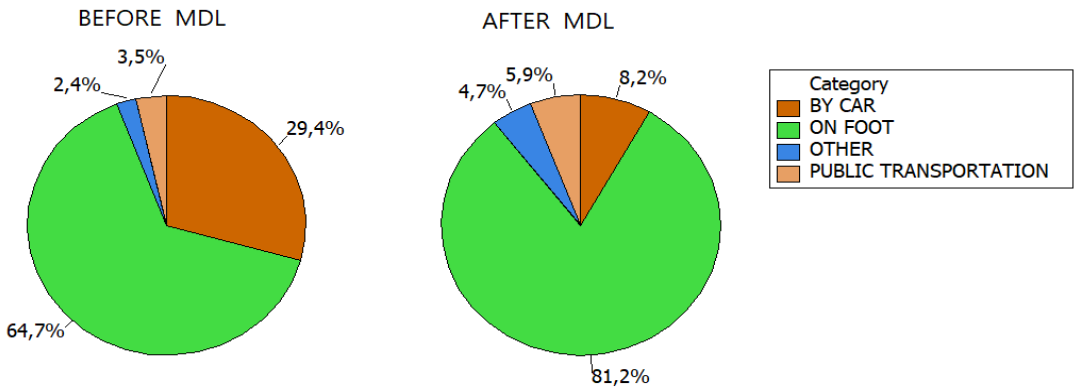

Figure 1b. Pie Chart of “means of transfer” Before vs. After

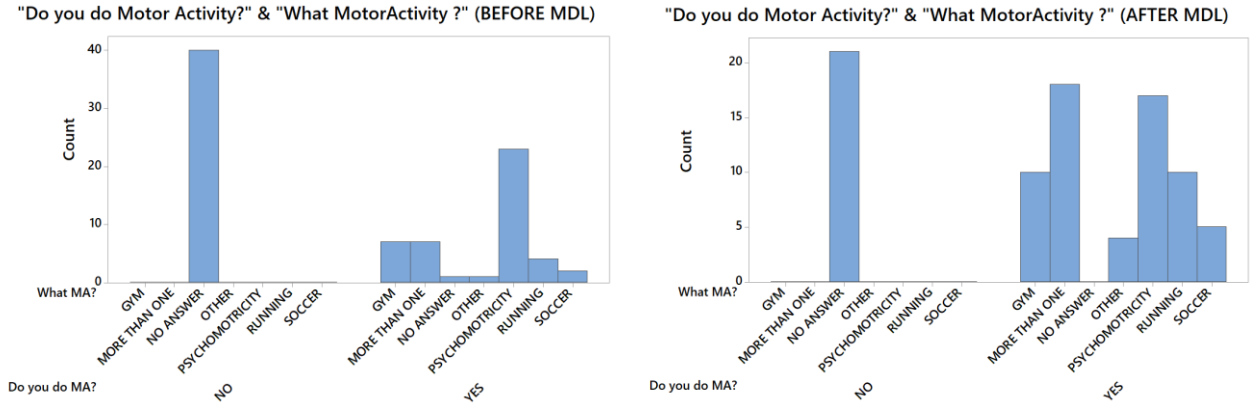

Figure 2. Change in the daily transfer/travelling style, with increasing motion by foot (top). Increased awareness after the MDL action is confirmed by the responses of the subsample who had answered "NO ANSWER" and after largely retreated (bottom), in favour of healthier lifestyle options

A second objective of MDL was to set out an educational action aimed at "breaking the routine" and "entertain" the students through the proposed motor activities. This cognitive approach acknowledges the importance of emotional involvement and the role of fun in learning, which traces back to the "Scanalan and Simon model" summarized within the "sport commitment model" (1992). Accordingly, having fun is regarded

as the main attractor towards sport and is defined as a positive response that reflects feelings of pleasure, contentment and satisfaction.

The MDL approach fully endorses this concept, making fun and pleasure its dominant themes. Figure 3 shows two panels about the "fun" perceived by the young students respectively towards sport and MDL expectations. In both cases, the "before vs. after" comparison confirms two important facts:

- The majority of the sample associates entertainment with the notion of sport;
- The sample perceived and acknowledged "fun" as a founding element of mdl (right-most panel), judging it even as the most important element after taking the mdl training.

The tenet "fun → information → result" is therefore an important aspect of an effective MDL action, which needs the active involvement of the audience for succeeding.

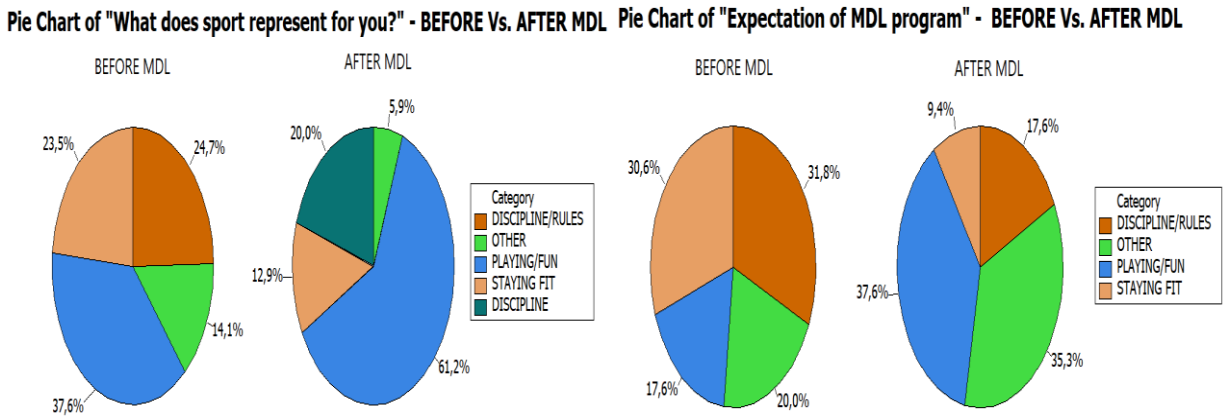

Figure 3. Perception of Sports (left) and expectations of the MDL program (right). The "fun" dimension is fundamental

Aware and healthy diet

The MDL integrates education on physical movement with the principles of healthy eating, which would affect the habits of the children. Taking the group of variables concerned in the "What do you eat normally [..]?" in the questionnaire, the breakfast, snack (at school, mid-morning) and lunch habits (respectively Figure 4, 5 and 6) appeared to have changed throughout the action. Figure 4 refers to breakfast and to snack, indicating:

- A reduced consumption of biscuits and cakes in favour of jam and fruits at breakfast;
- A reduction of the "no breakfast" subgroup;
- Increase in fruits and a decrease of snacks during snack-time at school.

In Italy, snack at school is typically a relevant meal but less "structured" than others, which is why it offers a sort of extra "degree of freedom" and was given particular attention in our MDL. In the two-stage histogram in Figure 5, a deeper analysis of the change in orientation of each sub-group, with respect to the first survey, shows that kids who had originally declared the sole consumption of snacks and sweets, afterwards, had steered their habits towards fruit, stuffed bread and salty snacks. Conversely, those who first ate only fruits added in some sweets to their diets. The sub-group of those who claimed to eat nothing came to realize that such a habit was strongly harmful and radically changed their habits in favour of fruit (mostly) and moderate

amounts of sweets, both good to support the daily learning activities at school. Other children, who first ate only stuffed bread or snacks, changed their habits by adding sweets and fruits. Only a few had maintained the old ways after the MDL.

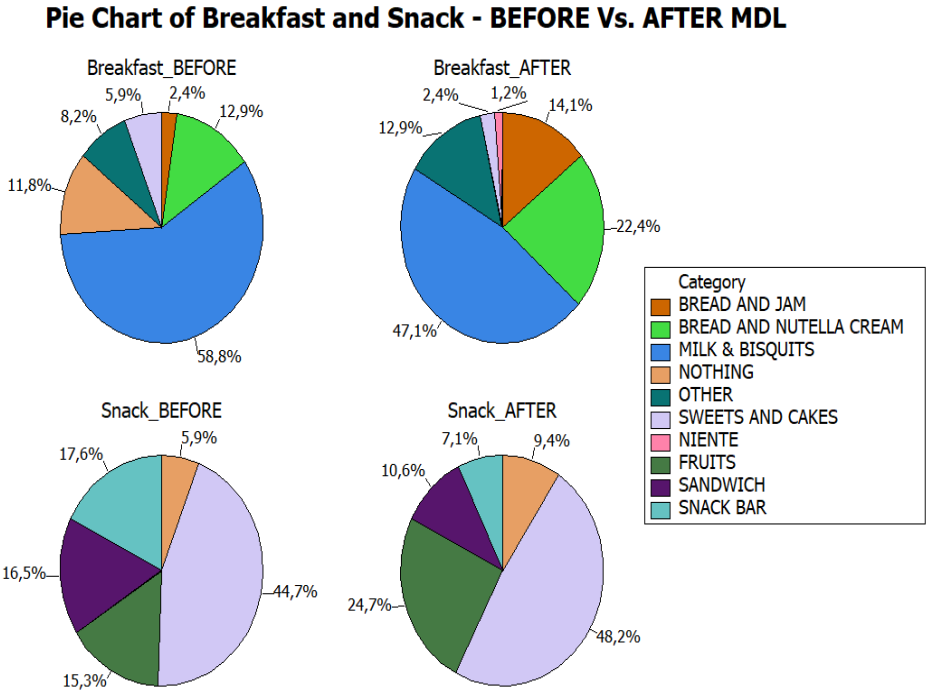

Figure 4. Eating habits for breakfast and snack-time (taken at mid-morning at school)

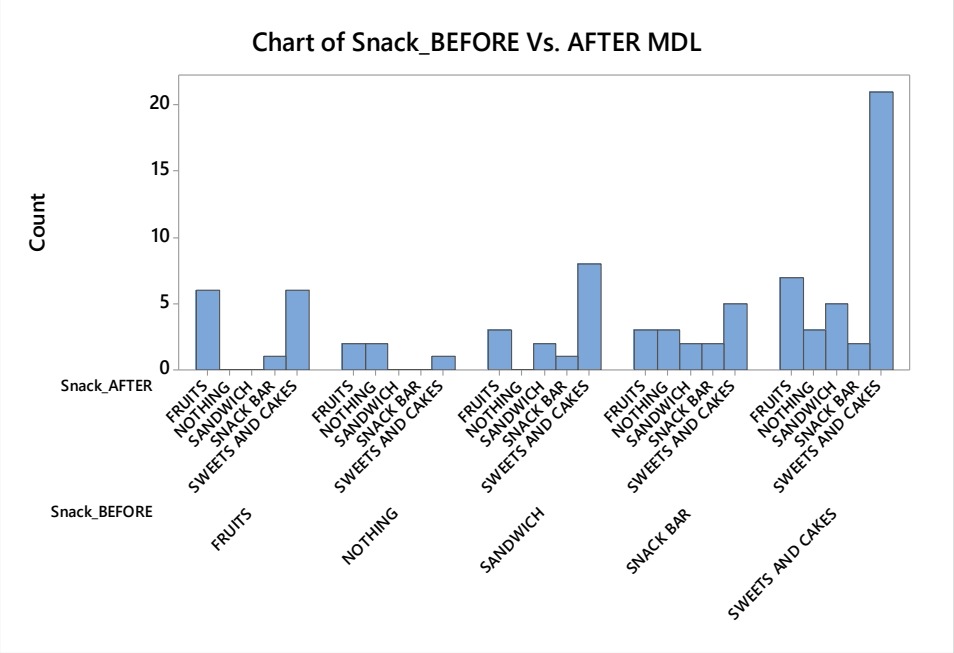

Figure 5. Comparisons before vs after on "What is your snack-time food when you are at school?"

Likewise, Figure 6 refers to lunch time and indicates:

- A marked increase (from 22.4% to 40%) of vegetables consumption, eaten together with the first and second courses, especially among those children who had the habit of eating only "the first and second";
- An increase in the statement of non-liking of the vegetables, which is seemingly paradoxical but needs to be understood as a result of the gain in terms of increased aware consumption; in other words "more children accept to eat vegetables but still dislike them".

Finally, greater awareness about hydration emerges from Figure 7, with a large increase in the percentage of the sample drinking water regularly after MDL.

Strong changes in diet habits and food preferences, as in this case, are very significant when compared with the time frame (a few months) in which they occurred. The MDL approach, therefore, seems a valuable tool to lessen the impact of obesity in young people, as it helps improving on both the active lifestyle and the diet quality, if administered properly.

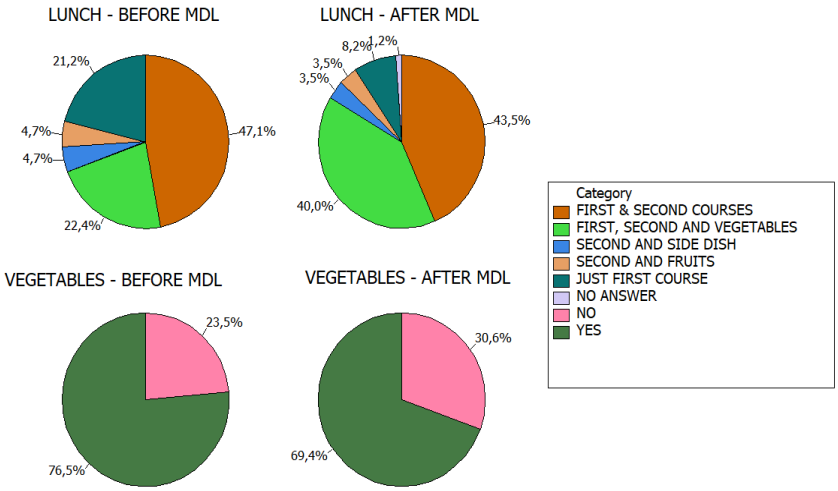

Figure 6. Eating habits about lunch and "liking vegetables"

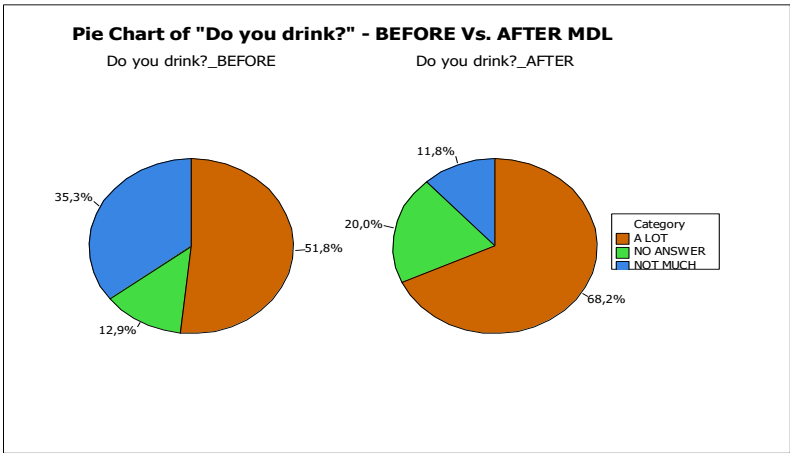

Figure 7. Habits in drinking water

Gender comparisons: Males vs. females

It should not be overlooked that the impact of the MDL may be different based on gender. In fact, reviewing the subgroups data for males vs. females reveals that the response is strongly gender-dependent. The males showed a tendency to keep with the same habits, while females showed a more receptive and plastic attitude. For example, looking back at Figure 6, vegetables are shown in Figure 8 to be typically part of the menu of the female population. Figure 8 also highlights how the increase of adverse liking for vegetables previously recorded in Figure 6 is due fundamentally to the male subgroup. In the "snack at school" composition in Figure 9, we observe that (i) both sub-groups prefer eating sweet snacks, (ii) the second most favourite snack is fruits for both, (iii) more males than females prefer to skip the snack all together. In the subset of males, we also notice a preference for stuffed bread rather than salty snacks, whereas for females there is no substantial difference. The male children demonstrated a steeper change than females in adopting a fruit as snack.

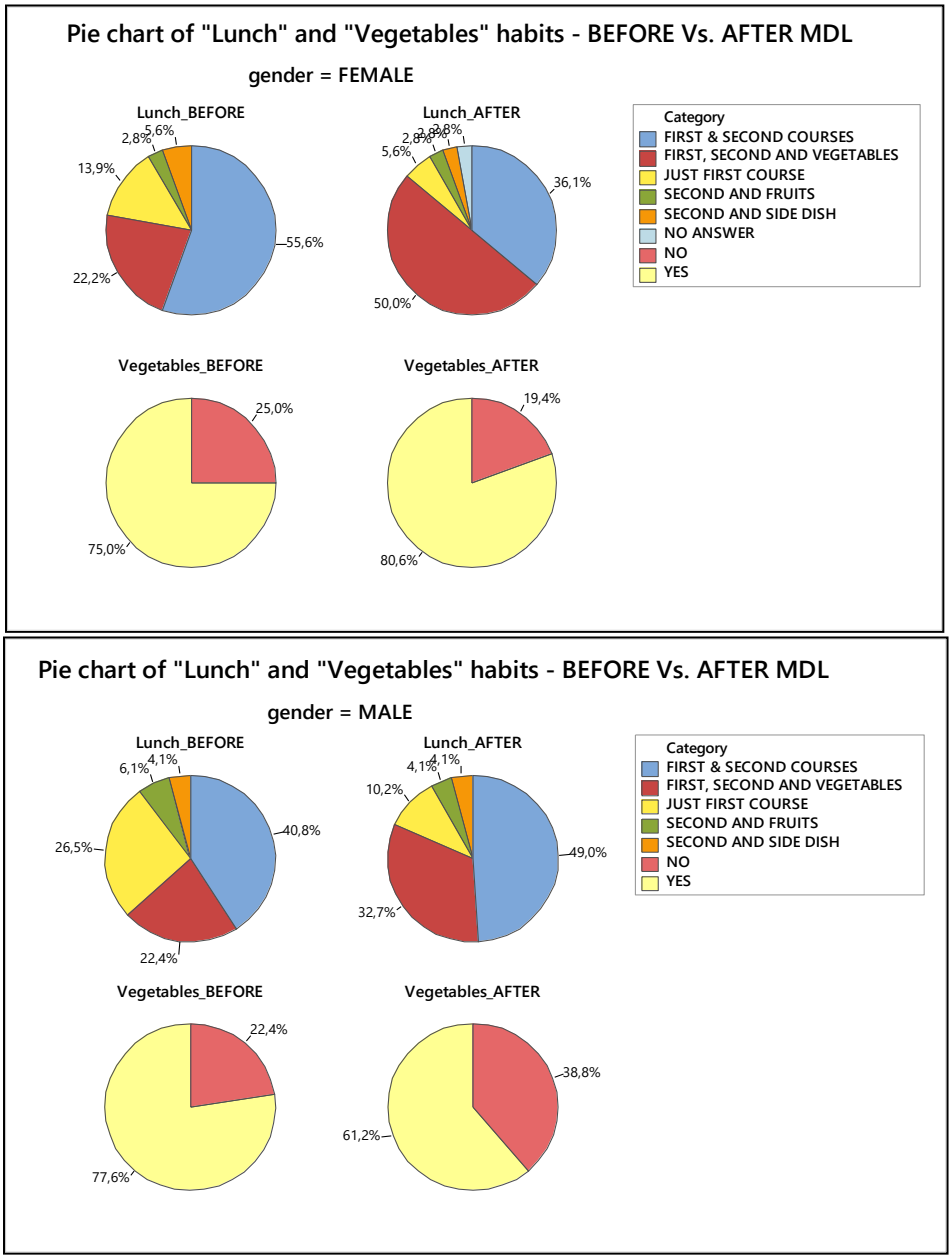

Figure 8. Impact of MDL on lunch habits evaluated by gender (females on left-most, males on right-most)

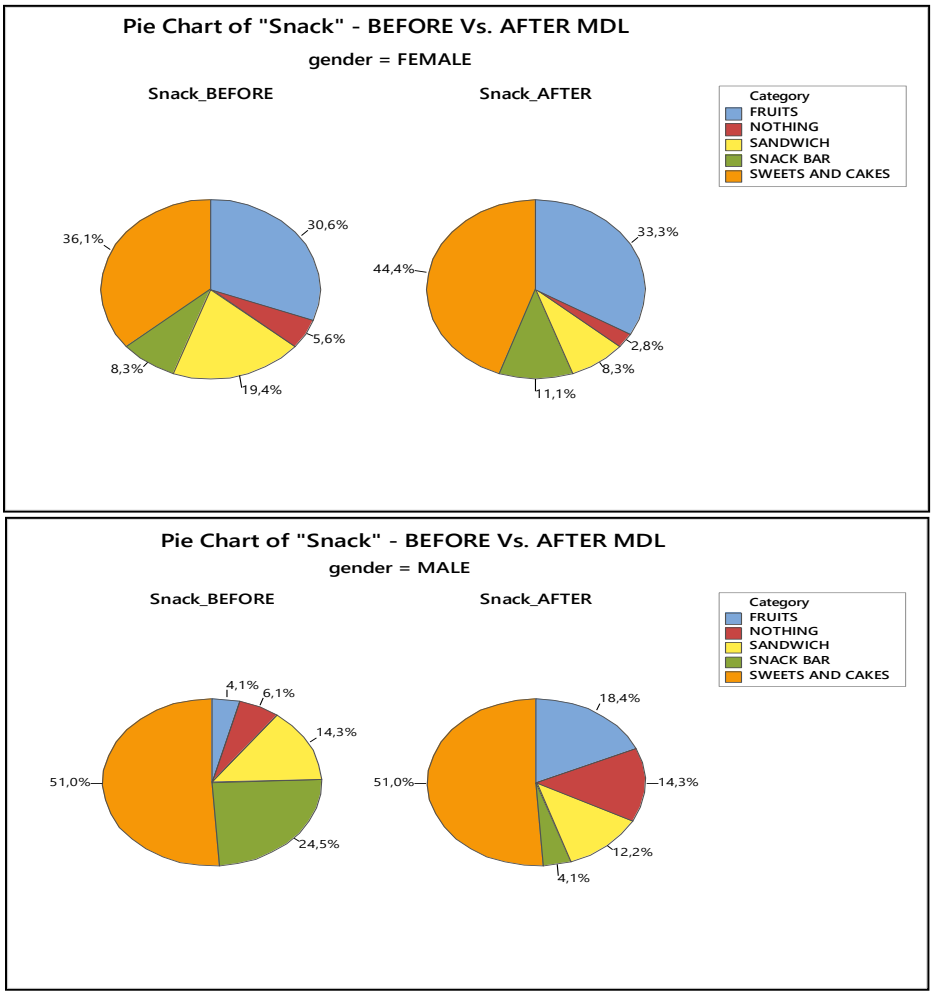

Figure 9. Impact of MDL in snack habits evaluated by sex (females on top, males on bottom)

All in all, these considerations suggest the "design" of future MDL actions on the basis of the sample composition, possibly by differentiating or managing the different "permeability" exhibited by males and females, for example by picking different activities to activate targeted emotional levers specific for each gender. Noteworthy, in addition to the gender factor, also the age factor should be given consideration because our data indicate that children of age between 5 and 7 years old were the most affected and quickly modified their eating and moving habits.

CONCLUDING REMARKS

Childhood obesity has a multifactorial genesis. As such, it is the result of various causes, more or less evident, that interact with each other, first and foremost excessive and bad diet habits, either or not linked to reduced physical activity and genetic (family) factors. The cases of obesity linked to hormonal changes such as hypothyroidism or adrenal dysfunction are comparatively rare (Confalone, 2002).It is important to keep in mind that an obese child will in most cases turn into an obese adult, because of both limited or no normal motor activity and excessive increase in adipose tissue during the development years.

Students in this study, especially the first classes, initially showed obvious difficulties in responding to the questionnaire, especially for food-related questions highlighting a lack of knowledge about nutrients.

However, their reply before the MDL proved quite eloquent and informative about some key aspects. With regard to questions about sport, many of them declared to had never done any sport or physical activity, with higher rate of total abstention in children 5-7 years old. The majority of the interviewees, with regard to questions concerning the transportation to get to school, claimed to opt for car or motorcycle, while very few used to walk. From the nutrition questions, a high rate of answers pointing to faulty eating habits emerged. In fact, when questioned about main meals, a high percentage of students conveyed that their daily intake of calories was largely characterized by unhealthy foods and scarce water uptake. Therefore the questionnaire proved effective in monitoring MDL and, in this case, to reveal poor "motor literacy ", aggravated by a lack of knowledge on correct nutrients.

The second administration of the survey, at the end of the MDL action, highlighted significant differences, especially about the practice of a "sport activity" or at least the motor activities. After MDL, almost all students began practicing at least one, with a widespread appreciation towards "motion" in general. The results about eating habits were not as striking, since almost all students continued to take unhealthy foods, albeit with greater awareness and by ackwledging fruits and vegetables. Yet, considering the short amount of time and the young age of the children, These results should not be dismissed as unsatisfactory. To the contrary, this research points out the importance of Motor Literacy as an effective educational strategy in the first place, but above all the need to pursue a healthy lifestyle (i.e. increased activity plus improved nutrition) in a school context of a region and a city that shows alarming data as far as childhood obesity and related metabolic diseases.

One should not underestimate also the psychological consequences, which can drag and amplify over time. Excess weight children may feel uncomfortable and ashamed, to the point of reaching an outright rejection of their physical appearance. Children are often derided, victims of jokes by peers, exposed at risk of losing self-esteem and develop a sense of insecurity that may lead them to isolation. In turn this may cause them to go out less and stay home more time watching television, thus setting up a vicious circle that also brings up reactive hyper-eating. (Confalone, 2002).

Finally, about the economic consequences of obesity, a real calculation of the costs of childhood obesity is very difficult to estimate, because it would need a methodology that takes into account the costs for all associated disorders recalled so far. However, numerous studies have assessed the costs incurred by the different health systems of many industrialized countries for obesity in general. According to Schoeller (The American Journal of Physiology, 1997), itis conceivable to avoid a weight gain by setting up a "threshold level" of exercise corresponding to approximately 80 minutes of moderate physical activity or equivalently 35 minutes of vigorous activity per day (Giampietro, 1998 - page 7). Therefore, it is sufficient to practice, regularly, light aerobic activities, without straining too much the body (like a bike ride or walk),which put a moderate yet steady effort on the muscles and cause them to draw "fuel" mainly from fat reservoir (Confalone, 2002).

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http://www.sportgoverno.it/media/64144/pianonazionalepas_definitivo2012.pdf

APPENDIX: SURVEY DATA DETECTION

PRE-COURSE OF LITERACY

Date of disclosure: _____

GENERAL INFORMATIONS

INDIVIDUAL: _____

AGE:_____

GENDER (M/F):

INTERESTS:

RESIDENCY:

1. What is the sport for you?

2. Have you practiced "motor" activities?

2b. If yes, what type of physical activity? Specify what is meant by physical activity (activities aimed at combating the sedentary habits).

3. Have you practiced sport? At a competitive level or amateur? What kind of sport? (Football, volleyball, etc.)

4. As you move normally when you leave home, for example to get to school? If you could choose would use another means to move?
□On foot □ Public transport □ Car □ Other

5. Do you devote to running (running)?
□ Always □ Sometimes □ Never

6. Regarding your breakfast, what you eat regularly?
□ Sweet □ Milk and cookies □ Bread and Nutella □ Bread and jam
□ Nothing □ Other

7. What is your snack when you are at school? And when you're home?

8. What do you usually eat for lunch? And at dinner?

9. Do you like vegetables?

10. Are you used to eating less (Y/N)?

11. Are you used to eating while watching television?
□ Always □ Sometimes □ Never

12. Are you used to eating while you study?

□ Always □ Sometimes □ Never

13. Are you used to drink a lot or a little in between meals?

14. What do you expect from this MDL program?

15. Do you have suggestions?